

# A Review of the Impact of Antenatal Care for Australian Indigenous Women and Attempts to Strengthen these Services

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## Abstract

**Objectives** To review evaluations of changes in the delivery of antenatal care for Australian Indigenous women and the impact on care utilization and quality, birth outcomes and women's views about care.

**Methods** Seven databases were searched electronically for articles describing evaluations of antenatal care programs developed for Australian Indigenous women. Manual searches were performed of the publication sections of websites of Australian Government Departments responsible for health and Indigenous affairs.

**Results** Evaluations of 10 antenatal care programs were identified. Wide variations were present in the design, quality and reported outcomes of each evaluation. There was a lack of consistency in the findings across all care programs for many outcomes. Modest increases were reported for measures of care utilization, including the proportion of women initiating care in the first trimester and the mean number of antenatal visits overall. For birth outcomes, benefits were reported by some but not all care programs for perinatal mortality, preterm birth, mean birth weight and the proportion of low birth weight infants. Of the four care programs reporting women's views about care, most comments were positive reflections about care, including the use of female staff and the continuity of care providers.

**Conclusions** The impact of the antenatal care programs evaluated and published to date remains inconclusive. Limitations arose from the diversity in the design of evaluations and the quality of reported data. This review has highlighted the need for good quality long-term data collection about the health services providing antenatal care for Australian Indigenous women.

**Keywords** Australia · Birth outcomes · Indigenous women · Maternity services · Prenatal care

## Introduction

The aim of antenatal (prenatal) care is to provide effective and appropriate screening, preventive or treatment interventions [1] so as to maximise the health of all women during and after pregnancy, and their infants. In Australia, approximately 3.5% of all mothers are Aboriginal and/or Torres Strait Islander (Indigenous) [2]. The number and proportion of Indigenous mothers varies by State and Territory, with the highest proportion occurring in the Northern Territory (39% in 2002) and the highest number of Indigenous mothers reported in Queensland (8,212 women in 2002) [2]. Depending on the State or Territory, the type of community Australian Indigenous women reside in may also vary, ranging from major capital cities or large regional coastal towns to smaller communities in rural and remote areas.

Indigenous women suffer disproportionately high rates of adverse pregnancy outcomes, relative to other Australian women, as is clearly illustrated by the consistently higher rates of perinatal mortality (21.4 per 1,000 perinatal deaths for births to Indigenous mothers compared with 9.6 per 1,000 perinatal deaths for births to non-Indigenous

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mothers), preterm birth (13% compared with 7%) and low birth weight babies (12.9% compared with 6%)<sup>1</sup> [2]. The causes of such excessive rates of perinatal morbidity and mortality experienced by Indigenous women are likely multifactorial and complex. High rates of smoking [3], adolescent pregnancies and grand multiparity [4], often compounded by disadvantage due to socio-economic status and location, and the related factors of dispossession and alienation may all contribute.

Indigenous women access antenatal care differently from other Australian women. Most Indigenous women (98%), including those residing in rural and urban areas, give birth in a hospital setting [4]. They are however, more likely to present later in pregnancy for their first antenatal visit and consequently have fewer antenatal care visits [5–7]. Achieving equity in access and utilization of antenatal services is vital in order to address the clear health disparities Indigenous women face. Barriers to accessing antenatal care and other primary health care may be present at many levels; some may relate to the organization or availability of services and socioeconomic factors, however care that is inappropriate to the cultural context is often highlighted as a major barrier to accessing mainstream services [8]. Attempts to address some of these barriers have occurred with the increasing provision of primary health care for Indigenous people by Aboriginal community controlled health services (ACCHS), many of which offer antenatal care. ACCHS are distinct from mainstream services as they are initiated and managed by Boards which include elected members from the local Aboriginal community. These types of services provide a means of access to culturally appropriate and comprehensive primary health care.

The aim of this paper is to review evaluations of changes to services or changes in the delivery of antenatal care for Australian Indigenous women and the impact on utilization and quality of care, birth outcomes and maternal views about care.

## Methods

Studies were considered for inclusion in this review if they were published evaluations of either an antenatal care program or an explicit change in the provision of maternity services specifically developed to address the health needs of pregnant Australian Indigenous women. Studies were excluded if they were: not specifically about antenatal care, for example family planning, sexual health, breast feeding or infant care interventions; commentary or discussion about the need for better service provision; reports of

descriptive epidemiology about patterns of care utilization or disparities in birth outcomes; descriptions of Indigenous cultural practices surrounding pregnancy and giving birth; or changes in service provision or interventions that were not specifically for Australian Indigenous women. Where care programs were identified for Indigenous women, studies were excluded if there was no formal evaluation undertaken or reported. Decisions about inclusion or exclusion of studies in the review were not based on quality, either of the intervention or the evaluation.

The pre-specified outcomes of interest in the review included measures of care utilization (for example gestational age at first antenatal visit, number of antenatal visits, antenatal hospitalisation, and other measured indicators of use of care) and any of the following health outcomes: perinatal mortality, maternal mortality, pre-eclampsia, anaemia (antenatal or postpartum), treated urinary tract infection including pyelonephritis (requiring antibiotic treatment or hospital admission), preterm birth (< 37 weeks' gestation), low birth weight (birth weight less than 10th percentile, or birth weight < 2,500 g), birth weight (mean or median) and measures of maternal alcohol, tobacco and other drug use in pregnancy. These health outcomes were chosen as they reflect outcomes most likely to be influenced by provision of antenatal care [1] and also represent health outcomes that are more commonly experienced by Australian Indigenous women compared with other Australian women.

Other outcomes of interest included measures of quality of care: care consistent with antenatal clinical practice guidelines; models or programs that included interventions where there is good evidence of benefit; adherence to treatment interventions; women's views about care and satisfaction with care; and measures of cost and cost-effectiveness.

The following electronic databases were searched: PubMed (1950-February 2006); Nursing & allied health (CINAHL)-CD (1982-December 2005); Cochrane Controlled Trials Register (CCTR) (The Cochrane Library, Issue 1, 2006) [9]; and the following databases accessed through INFORMIT<sup>2</sup>: ATSIROM (Aboriginal and Torres Strait Islander Online—a collection of bibliographies related to Indigenous affairs including the Aboriginal and Torres Strait Islander Health Bibliography, 1900-February 2006); Australian Medical Index (1968-February 2006); Australian Public Affairs Information Service-Health (1978-February 2006); and RURAL (Rural and remote health database, 1966-February 2006).

The search strategy differed slightly for each of the databases searched, to account for different items in each

<sup>1</sup> Figures refer to births to Indigenous mothers, not all Indigenous births.

<sup>2</sup> The Source for Online Australasian Information, © Informit, RMIT Publishing.

database (see Fig. 1). Manual searches were also performed of the publication sections on the websites of the Australian Government’s Office of Aboriginal and Torres Strait Islander Health, the Australian Government’s Department of Health and Ageing and State and Territory Government health departments in January 2006. Approval from the relevant Human Research Ethics Committee was not required for this project as it involved a review of published literature only.

**Results**

Twenty-nine publications referring to fourteen distinct antenatal care programs or interventions were identified [6, 10–37].

Descriptions of each care program or intervention are provided in Table 1. Eight publications were identified from PubMed and a further 21 from the other electronic databases and a search of the bibliographies listed in the publications. Four of the 14 programs were excluded from further consideration in this review for the following reasons: no evaluation report was detected in the time frame of the review [35, 36] or the publications identified reported process indicators only and no health outcomes [30, 31, 37] or provided only a description of the program [32].

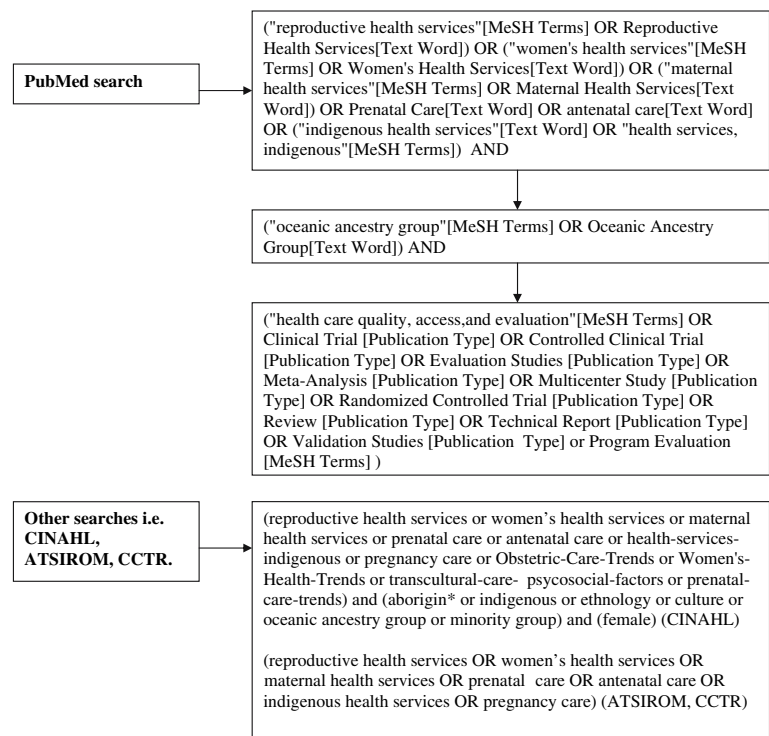
Not surprisingly, of the 10 care programs included in the review, most were linked in some way to an ACCHS often in partnership with mainstream health services. The majority of programs identified were based on a midwifery

model of care including primary health care principles. The design of the program evaluation varied widely across publications. It was not possible to compile information from each study to produce a single estimate of effect for individual outcomes, due to the diversity in study design and control groups; including before and after community interventions, the use of historical control groups, comparisons made with other Indigenous women in the area, comparisons with non-Indigenous women in the area and the use of routinely collected State or Territory-level Indigenous and non-Indigenous statistics. Many programs had multiple comparison groups. Information in this review is therefore reported separately for each program including the crude data used in each comparison (where reported). For comparisons where there was a statistically significant difference, an estimate of the magnitude of effect (the absolute difference) and the level of statistical significance are reported.

Care utilization and quality of antenatal care

The number of women utilising the care programs overall and as a proportion of Indigenous women in the various catchment areas varied widely, as did the type of care utilization measures reported (Table 2). The largest reported number of women seen during one care program evaluation period was 280 women and 456 births over 4 years [17]. Statistically significant increases in the number of women initiating antenatal care in the first trimester were reported by two programs [6, 12]; typically

**Fig. 1** Terms used in the literature search



**Table 1** Description of programs

Program	Setting	Program description/service change	Evaluation outcomes
Arnhem Land ultrasound training project [10]	<p>Location: Arnhem Land, Northern Territory.</p> <p>Description: Remote communities in Arnhem Land (approximately 100,000 km<sup>2</sup> of Aboriginal owned land in the North-Eastern part of the Northern Territory).</p> <p>Implementation year: unclear.</p> <p>Links with other services: Communities are supported by an Aboriginal Health Worker team linked to local community controlled health centers and the district hospital in the town of Nhulunbuy.</p>	<p>Training of female Aboriginal health workers in the use of real-time ultrasound scanning for antenatal care, as a means of early detection of high risk pregnancies. Care provided is routine antenatal care, but with increased opportunity for antenatal ultrasound.</p>	<p>An assessment of the accuracy of the health workers' diagnosis of obstetric complications detectable on ultrasound.</p>
Congress Alukura [11]	<p>Location: Alice Springs, Northern Territory.</p> <p>Description: Urban clinic in a regional centre, offering services to women living in the town of Alice Springs and in rural and remote communities/outstations within 100 km of the town.</p> <p>Implementation year: 1997.</p> <p>Links with other services: Central Australian Aboriginal Congress, an Aboriginal community controlled health service (ACCHS), and the Alice Springs Hospital birthing facilities.</p> <p>During the evaluation time period, Alukura was utilized for some or all antenatal care by 98% of urban Aboriginal women and by 18% of rural Aboriginal women in the Alice Springs area.</p>	<p>Development of a women's health service within a primary health care model and "embedded in the knowledge of the Traditional Grandmothers".</p> <p>Services include: comprehensive antenatal and postnatal care, shared antenatal care, gynecological services, sexual assault and domestic violence counselling and examinations, health education, transportation, health worker training and a bush mobile clinic. Birthing facilities are available at the clinic.</p>	<p>Comparison of indicators of care utilization, and birth weight, before and after the intervention, in addition to an assessment of the perceptions of women and health care providers about the service.</p>
Daruk Antenatal Program [12], see also [13]	<p>Location: Sydney, New South Wales.</p> <p>Description: Urban clinic in a capital city, offering services for the urban Indigenous women in Western Sydney.</p> <p>Implementation year: 1990.</p> <p>Links with other services: Daruk Aboriginal Medical Service, an ACCHS, and birthing facilities at Nepean and Blacktown Hospitals.</p> <p>During the evaluation period, women attending Daruk represented approximately 40% of all Aboriginal women who gave birth in the Western Sydney area.</p>	<p>Development of a culturally appropriate midwifery program, staffed by a full time Aboriginal health worker, a non-Aboriginal midwife, and two female general practitioners.</p> <p>Services include: regular antenatal check-ups, hospital bookings, transport, home visits, labour support and delivery, hospital visits, management of high risk pregnancies in the community in consultation with a specialist medical team, infant feeding assistance, and cultural awareness training for local hospital staff.</p>	<p>Comparison of indicators of care utilization, quality of care, pregnancy outcomes, women's views and a cost-analysis, between Daruk clients and other Indigenous women receiving care at Nepean or Blacktown hospitals in the same time period.</p>
Gumilebyrra Women's Health Service [14], see also [15, 16]	<p>Location: Darwin, Northern Territory.</p> <p>Description: Urban clinic in a small capital city, offering care for Indigenous women in the Darwin urban area.</p> <p>Implementation year: 1994.</p> <p>Links with other services: Danila Dilba Health Service, an ACCHS, and the Royal Darwin Hospital (RDH) birthing facilities.</p>	<p>Development of a culturally appropriate women's health service, which included setting up a "women's only" clinic, operating two days a week with female only staff.</p> <p>Services include: antenatal and postnatal care, "well women screening", managing women's and infant's health problems in addition to community activities, home-visiting and linking in with other community organizations providing care for women and infants.</p>	<p>Comparison of antenatal care utilization for the years 1994 and 1999, for women delivering at RDH, in addition to an assessment of women's views of care about the service.</p>

**Table 1** continued

Program	Setting	Program description/service change	Evaluation outcomes
Mums & Babies Program [17], see also [18]	Location: Townsville, Queensland. Description: Urban clinic in a regional centre offering services for Indigenous women in Townsville and surrounding areas (North and Far North Queensland). Implementation year: 2000.	Development of an integrated model of antenatal shared care, based on “common sense”; continuity of care, cultural currency and safety and a family friendly environment, co-located with mental health, dental and social support services.	Comparison of indicators of care utilization, quality of care, and selected pregnancy outcomes between Indigenous women attending TAIHS before and after the introduction of the program, and compared with Indigenous women in the same time period who were not clients of the program.
Nganampa Health Council (NHC) [19]	Links with other services: Townsville Aboriginal and Islander Health Services (TAIHS), an ACCHS, and the Townsville Hospital birthing facilities. At the end of 2003, women attending the Mums and Babies program accounted for 43.7% of the 641 Townsville based Indigenous women giving birth at Townsville Hospital.	Services include: daily maternal and child health clinics, which provide women with the opportunity to see Aboriginal health workers, midwives, female doctors, an obstetric team from Townsville hospital and an Indigenous outreach health worker.	Comparison of pregnancy and outcomes for the years 1984–1990 prior to the introduction of the protocols compared with the years 1991–1996.
Ngua Gundi (Mother/Child Project) [20], see also [21, 22]	Location: Anangu Pitjantjatjara (AP) Lands, South Australia. Description: Clinics in remote communities in the AP Lands (approximately 105,000 square kilometers of Aboriginal owned lands in the North-West of South Australia). The NHC, an ACCHS operates six main clinics and three clinics in smaller communities throughout the AP Lands. Implementation year: 1991.	Introduction of “standard protocols for antenatal care and birthing” in conjunction with other protocols relating to women’s health, sexually transmitted infections, childhood immunizations, growth monitoring and other significant illnesses; and employment of female staff and a midwife in each clinic.	Comparison of pregnancy outcomes of women using the Ngua Gundi service and the known Indigenous births in the area for the period 1993–1996 and 1997–2000.
Strong Women, Strong Babies, Strong Culture (SWSBSC) Program [6], see also [23–26]	Location: Rockhampton, Queensland. Description: Urban clinic in a regional centre offering services for Indigenous women resident in Rockhampton and surrounding areas, including the Woorabinda community. Implementation year: 1993. Links with other services: Rockhampton Base Hospital birthing facilities, Woorabinda Health Service, Woorabinda Hospital. During the evaluation period, Ngua Gundi cared for approximately 21% of the known Indigenous women giving birth at Rockhampton Base Hospital in that time period. Location: Rural and remote communities, Northern Territory (NT) and Western Australia (WA). Description: Self-selected communities in rural and remote areas of the NT (Darwin Rural and East Arnhem Land) and WA (Kimberley Region). Implementation year: 1993. Links with other services: Local health clinics (ACCHS’s and government run services) and District hospitals for birthing facilities.	Development of a community midwifery program delivering continuity of care, including clinic based and home-visiting antenatal and postnatal services, group or one-on-one antenatal education, and a postnatal education mothers group. Transport is provided for mothers and children to attend the clinic. Development of a community based support program, where Strong Women Workers (SWW) are employed to support pregnant women in the community, including encouraging women to visit clinics for antenatal care early in pregnancy and providing advice about healthy pregnancy management in relation to nutrition, substance misuse and seeking medical assistance when required.	Comparison of pregnancy outcomes pre- and post-intervention years in three pilot communities and in communities where the program was later extended to. Comparisons are also made with three rural Top End Northern Territory regions.



Table 1 continued

Program	Setting	Program description/service change	Evaluation outcomes
Women's Business Service (WBS) [27], see also [28]	Location: Mildura, Victoria. Description: Urban clinic in a regional centre offering services for Indigenous women in the Mildura area. Implementation year: 2000. Links with other services: Mildura Aboriginal Health Service, an ACCHS, and birthing facilities at local district hospitals.	Development of a midwifery program to "provide personalized care that takes a holistic view of health during pregnancy", provided by a registered midwife and an Aboriginal maternal health worker. Services include: antenatal and postnatal care (clinic based and outreach), health education and information, support for women during labour and birth (either in hospital or at home) through a 24-h on call service. Transport services to and from hospital are provided.	Comparison of the views and experiences of women who received care at the WBS, compared with rural Victorian women who participated in the Statewide Victorian Survey of Mothers and Babies.
Yapatjarra Shared Care Program [29]	Location: Mount Isa, Queensland. Description: Urban clinic in a regional centre offering services for Indigenous women in Mount Isa and the surrounding districts. Implementation year: 2002. Links with other services: Yapatjarra Medical Centre, an ACCHS and Mount Isa Hospital birthing facilities.	Development of a shared antenatal care program for Indigenous women. Services include: fortnightly clinics at the local ACCHS and an outreach service providing remote areas with access to a medical officer. Aboriginal health workers also visit Indigenous clients in the community to help facilitate attendance and transport services are provided.	Comparison of indicators of care utilization, and the perinatal mortality rate before and after the intervention.
Programs not further included in this review			
Aboriginal Maternity Service [35], see also [37]	Location: Tamworth, New South Wales. Description: Urban clinic in a regional centre offering services for Indigenous women in Tamworth and within 100 kilometers of Tamworth. Implementation year: 1998. Links with other services: Tamworth Base Hospital birthing facilities.	Development of a midwifery program and antenatal clinic that offers care, encouragement, support and education for Indigenous women and non-Indigenous women with an Indigenous partner. Services include: a full-time Health Education Officer and community midwife offering home visiting antenatal and postnatal services, and a weekly antenatal clinic with additional staff including an obstetrician, a second midwife and volunteers.	Reporting of process indicators only.
Djulgilbhan Maternity Program [36]	Location: Kempsey, New South Wales. Description: Urban clinic in a regional centre offering services for Indigenous women in Kempsey. Implementation year: Unclear. Links with other services: Durri Aboriginal Medical Service (AMS) and Kempsey District Hospital birthing facilities.	Development of a community midwifery program that offers antenatal care to Indigenous women and non-Indigenous women with an Indigenous partner. Services include: antenatal care (clinic based or in the home) including shared care between midwives and a General Practitioner, postnatal follow up and childhood immunisation services and transport to the clinic.	Unclear, no evaluation report available in the time frame of the review.
Koori Pilot Birthing Service Projects [30], see also [31]	Location: Regional communities in Victoria. Description: Indigenous communities in the Lakes Entrance, Shepparton / Mooroopna, Mildura / Robinvale, Ballarat, Goulburn and Warnambool, regional areas of Victoria with health clinics located primarily in urban centers. Implementation year: 1992–1994. Links with other services: Local health centres (ACCHS's and government-run services) and birthing facilities at local district hospitals.	Development of primarily midwifery-based programs designed to provide culturally appropriate antenatal and postnatal education and support programs for Koori (Indigenous) women. Care was tailored to the individual communities and their health centre facilities.	Reporting of process indicators only for six of the pilot projects.

Table 1 continued

Program	Setting	Program description/service change	Evaluation outcomes
Ngunyju Tjitji Pimi enhanced Antenatal Program [32]	Location: Kalgoorlie Boulder, Western Australia. Description: Urban clinic in a regional centre offering services for Indigenous women in Kalgoorlie and the Goldfields area. Implementation year: 1993. Links with other services: Ngunyju Tjitji Pimi Aboriginal Corporation, an ACCHS and Kalgoorlie Regional Hospital birthing facilities.	Development of a community based ‘‘culturally acceptable’’ Aboriginal Maternal and Infant Health service. Services include: weekly home visits and screening with a focus on the detection of intrauterine growth restriction, pre-eclampsia, urinary tract infections, and diabetes. Primary health care (including antenatal care) outreach services are also provided.	Program description only, no evaluation reported.

increases in the order of 10% were seen. However, only one program [12] reported a significantly earlier gestational age at first antenatal visit for women attending the care program. Not unrelated to the timing of initiation of care, increases in the mean or median number of antenatal visits over pregnancy were reported by two programs [12, 17]. By contrast, one program reported an overall decline in antenatal visits pre versus post-intervention (8.9 visits, standard deviation (SD) 4.3; to 7.3 visits, SD 3.8) [6]. A reduction in the number of women with ‘inadequate care’ (variously defined) was reported by two programs [17, 29].

Measures of quality of care were poorly reported, with only three care programs reporting on quantifiable aspects of quality of care. An increase in the proportion of women attending for routine antenatal tests was reported for one care program [12] (94% compared with women attending two other hospital-based services reporting 71%,  $P = 0.01$  and 84%,  $P = 0.02$ ). For another program, graphical representations were provided showing increases in recorded care planning, smoking cessation advice, antenatal education and changes in the screening activity over the study period [17]. Another publication reported an assessment of the quality of care related to the specific intervention, an ultrasound training program [10], which indicated that after training, Aboriginal health workers were able to correctly identify most obstetric complications detectable on ultrasound, with the exception of identifying a gestational age sac < 12 weeks’ gestation.

Health outcomes

The most commonly reported health outcomes were perinatal deaths or the perinatal mortality rate, preterm birth, mean birth weight and the proportion of low birth weight babies (< 2,500 g) (Table 3). Of the five programs reporting perinatal deaths or the perinatal mortality rate, three demonstrated no significant difference in the comparisons [12, 17, 20], one [29] reported six fewer deaths in the 6 months after the intervention but no further information was provided, and one program [19] reported a reduction of 36.6 per 1,000 perinatal deaths (95% Confidence Interval (CI) around the difference -60.3 to -12.8) in the perinatal mortality rate (from 45.2/1000 to 8.6/1000) after introduction of the program. Improved perinatal survival was reported by one care program (100% vs. 98%,  $P = 0.05$ ) [12].

Of the four programs that reported preterm birth, one [17] reported a reduction in preterm birth when women attending the care program were compared with historical controls (8.7% vs. 16.7%,  $P = 0.044$ ), compared with other Aboriginal women giving birth in the same time period (8.7% vs. 14.3%,  $P = 0.002$ ) and when compared with births to Queensland Indigenous women overall (8.7% vs.

**Table 2** Measures of care utilization and quality of care

Program	Comparison	Outcome	Findings
Arnhem Land ultrasound training project [10]	Comparison between seven female health workers and an obstetrician (the trainer) for the correct diagnosis of obstetric conditions. <sup>a</sup>	Correct diagnosis of twins	100%
		Correct diagnosis of fetal death	100%
		Correct diagnosis of breech presentation	84%
		Correct diagnosis of biparietal diameter measurement	67%
		Correct diagnosis of ‘phantom pregnancy’	67%
Congress Alukura [11]	Attendance records at Alukura for 1994 and 1995.	% of women initiating care in the first trimester	35–40%
	Women giving birth at Alukura 1994–95.	% women with a first antenatal visit at or after 25 wks gestation	< 20% overall
		Number of women giving birth	13 women (21 women booked at 36 wks <sup>b</sup> )
	Women giving birth at Alukura 1996–98.	Number of women giving birth	3 women <sup>c</sup>
Use of routinely collected perinatal statistics about Indigenous women in Alice Springs for the years 1986–90 and 1991–95.	% women initiating care in the first trimester	21–33%	
Daruk Antenatal Program [12]	Daruk clients ( <i>n</i> = 185) versus other Indigenous women having care at Nepean Hospital ( <i>n</i> = 105), between October 1990 and December 1996.	Mean gestational age (weeks) at first antenatal visit	17.2 vs. 21.2**
		% women initiating care in the first trimester	37% vs. 22%**
		Mean number of antenatal visits	10.5 vs. 5.5**
	Daruk clients ( <i>n</i> = 185) versus other Indigenous women having care at Blacktown Hospital ( <i>n</i> = 90), between October 1990 and December 1996.	Attendance for routine antenatal tests	94% vs. 71%**
		Mean gestational age (weeks) at first antenatal visit	17.2 vs. 19.9*
		% women initiating care in the first trimester	37% vs. 24%*
Gumilebyirra Women’s Health Service [14]	Attendance at Gumilebyirra as a proportion of the Darwin region Indigenous women birthing at the Royal Darwin Hospital (RDH) in 1994 and 1999.	Mean number of antenatal visits	10.5 vs. 9.5
		Attendance for routine antenatal tests	94% vs. 84%*
Mums & Babies Program [17]	Births to mothers in the Mums & Babies Program ( <i>n</i> = 456) between 1 Jan 2000–31 Dec 2003, compared with births in a historical control group ( <i>n</i> = 84) of TAIHS clients giving birth between 1 January 1998 and 30 June 1999.	Proportion of women attending in 1994 and 1999	15.2–18.9%
		Proportion of antenatal visits at the service in 1994 and 1999	5.7–8.9%
		Median (IQR) gestational age (weeks) at first visit	12 (8–20) vs. 14 (7–22)
	Pregnancies with ‘inadequate care’ (not defined)	Median (IQR) number of antenatal visits	7 (4–10) vs. 3 (2–6)***
		Pregnancies with a late first antenatal visit (not defined)	19.1% (87/456) vs. 52.4% (44/84)***
	Women attending the Mums & Babies Program between 1 Jan 2000–31 Dec 2003, as a proportion of the number of Indigenous women giving birth at Townsville Hospital in 2000 ( <i>n</i> = 189) and 2003 ( <i>n</i> = 103).	11.0% (50/456) vs. 17.9% (15/84)*	Overall attendance in the program
Women attending the program between 2000 and 2003 with ≥ 1 ultrasound scans <sup>d</sup>		91.7%** <sup>e</sup>	
Women attending the program between 2000 and 2003 with a dating scan		57.0%** <sup>e</sup>	



**Table 2** continued

Program	Comparison	Outcome	Findings
		Women attending the program between 2000 and 2003 with a morphology scan	78.9%
		Women attending the program between 2000 and 2003 with STI screening	88.4%
		Women attending the program between 2000 and 2003 with GBS screen	55.8%
		Women attending the program between 2000 and 2003 with Hb, hep B, syphilis screen	82.5%*** <sup>e</sup>
Ngua Gundi [22]	Births to Ngua Gundi antenatal clients ( <i>n</i> = 123) between Feb 1993 and Nov 1996 and between Jan 1997 and Dec 2000 ( <i>n</i> = 123).	% of women initiating care in the first trimester	29–37%
		% women with ≥ 6 antenatal visits	65.4–64%
Strong Women, Strong Babies, Strong Cultures, NT [6]	Women in the NT pilot communities pre ( <i>n</i> = 210) and post-intervention ( <i>n</i> = 212), as reported in the first evaluation report (1998).	Mean gestational age (weeks) at first antenatal visit	19.1 (SD 6.8) to 18.4 (SD 7.8)
		% women initiating care in the first trimester	16.7–24.4%*
		Mean number of antenatal clinic visits	8.9 (SD 4.3) to 7.3 (SD 3.8)
Yapatjarra Shared Care Program [29]	Attendance prior to and in the 6 months after the implementation (Jan–June 2002 vs. Jul–Dec 2002), no denominators provided. <sup>f</sup>	Number of women presenting to hospital without antenatal care	10–2
		Proportion of women actually attending booked appointments	5/8 to 9/10 booked appointments

GBS, group B streptococcus; Hb, haemoglobin; hep B, hepatitis B; IQR, interquartile range; SD, standard deviation; STI, sexually transmitted infection; wks, weeks; vs., versus

\* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\* $P < 0.001$

<sup>a</sup> Eleven (5%) of the women scanned were transferred to Darwin due to risk factors detected in the screening, and 35 women delivered outside of hospital by choice

<sup>b</sup> Eight women were transferred to other care before or in the first stage of labour, two women were transferred postnatally

<sup>c</sup> Five women began labour there, two were transferred. At the time of publication (2004), no births had occurred at Alukura since 1997

<sup>d</sup> Other measures of quality of care reported included statistically significant ( $P < 0.001$ ) increases in the proportion of women in the program between 2000 and 2003 with recorded care planning, smoking cessation advice and antenatal education (graphical representations reported only)

<sup>e</sup> Statistically significant increases are recorded comparing screening activity over the years 2000 to 2003 for women attending the program

<sup>f</sup> Other changes reported were an increase in clinic hours from 2 to 3 h and a change from fortnightly to weekly sessions

12.3%,  $P < 0.05$ ). One other program [6] reported a reduction in preterm birth in communities pre and post-intervention (22.4% to 13.1%,  $P = 0.005$ ). No other differences were seen in the rate of preterm birth [12, 22].

Mean birth weight was reported for four care programs, and increases in mean birth weight over the study periods were reported for at least one of the comparisons undertaken in all of these programs [6, 11, 17, 19]. The magnitude of the birth weight increases ranged from 103 to 196 g. The proportion of low birth weight (< 2,500 g) or

small for gestational age babies was reported by five care programs [6, 12, 17, 19, 20], of which, two reported reductions in communities pre and post-intervention (15.3% to 10.9%,  $P = 0.0148$ ; 14.2% to 8.1%,  $P = 0.01$ ) [6, 19]. For the remaining programs, no significant differences in the proportion of low birth weight babies were reported.

Other reported health outcomes relevant to this review included the proportion of women diagnosed with pregnancy-induced hypertension (PIH), which was greater for

**Table 3** Health outcomes

Program	Comparison	Outcome	Findings	Absolute difference <sup>a</sup>
Congress Alukura [11]	Use of routinely collected perinatal statistics about Indigenous women in Alice Springs 1986–90 and 1991–95 (as a surrogate for Alukura clients).	Mean birth weight	3,168–3,271 g*** the standard deviation of birth weight was assumed to be at the population level of 500 g. The authors suggest the change in birth weight was sustained, and report mean birth weight from 1996 to 1999 as 3,268 g.	+103 g
Daruk Antenatal Program [12]	Daruk clients ( <i>n</i> = 174) versus Indigenous non-clients ( <i>n</i> = 219) giving birth at Nepean Hospital.	Perinatal deaths	0% (0/174) vs. 2% (5/219)	–
		Perinatal survival	100% (174/174) vs. 98% (214/219)*	+2%
		PIH	11% (19/174) vs. 5.1% (11/219)*	+6%
		Preterm birth	9% (16/174) vs. 12.3% (27/219)	–
		Birth weight < 2,500 g	12% (21/174) vs. 12% (27/219)	–
		Smoking during pregnancy	70% (62/89) vs. 71% (89/126)	–
		Smoke > 10 cigarettes/day	79% (48/61) vs. 60% (50/84)*	+19%
	Daruk clients ( <i>n</i> = 29) versus Indigenous non-clients ( <i>n</i> = 259) giving birth at Blacktown Hospital.	Perinatal deaths	3% (1/29) vs. 2% (6/259)	–
		Perinatal survival	97% (28/29) vs. 98% (253/259)	–
		PIH	3% (1/29) vs. 3% (8/259)	–
		Preterm birth	0% (0/29) vs. 9.3% (24/259)	–
		Birth weight < 2,500 g	0% (0/29) vs. 7% (19/259)	–
		Smoking during pregnancy	59% (10/17) vs. 69% (116/169)	–
		Smoke > 10 cigarettes/day	56% (5/9) vs. 65% (73/112)	–
	Daruk clients ( <i>n</i> = 153) versus other Indigenous women having care at Nepean ( <i>n</i> = 105) and Blacktown Hospitals ( <i>n</i> = 90).	Alcohol consumption during pregnancy	26% (38/153) vs. 28% (24/87) (Nepean) 26% (38/153) vs. 15% (12/79) (Blacktown)	– –
Mums & Babies Program [17]	Births to mothers in the program ( <i>n</i> = 456) between 01 Jan 00 and 31 Dec 03, compared with births in a historical control group ( <i>n</i> = 84) involving TAIHS clients birthing between 01 Jan 98 and 30 June 99. <sup>b</sup>	Perinatal deaths	2.4% (10/423) vs. 6.0% (5/84)	–
		Perinatal mortality rate	24/1000 vs. 60/1000	–
		Preterm birth (< 37 wks)	8.7% (37/423) vs. 16.7% (14/84)*	–8%
		Birth weight < 2,500 g	11.1% (46/413) vs. 15.5% (13/84)	–
		Small for gestational age	8.3% (34/410) vs. 2.4% (2/84)	–
	Mean birth weight	3,239 g (95% CI 3,170–3,308 g) vs. 3,043 (95% CI 2,864–3,224 g)*	+196 g	
	Births to mothers in the program 01 Jan 00–31 Dec 03 ( <i>n</i> = 456) compared with births to Indigenous women in the same time period who did not receive care at TAIHS ( <i>n</i> = 540). <sup>b</sup>	Perinatal deaths	2.4% (10/423) vs. 2.0% (11/540)	–
		Perinatal mortality rate	24/1000 vs. 20/1000	–
		Preterm birth (< 37 wks)	8.7% (37/423) vs. 14.3% (77/540)**	–5.6%
		Birth weight < 2,500 g	11.1% (46/413) vs. 13.9% (75/540)	–
Mean birth weight		3,239g (95% CI 3,170–3,308 g) vs. 3,188 g (3,124–3,253 g)	–	

**Table 3** continued

Program	Comparison	Outcome	Findings	Absolute difference <sup>a</sup>
Nganampa Health Council [19]	Births to mothers in the program 01 Jan 00 and 31 Dec 03 ( <i>n</i> = 456) compared with Queensland Indigenous births in 2001 ( <i>n</i> = 2729).	Perinatal deaths	2.4% (10/423) vs. 2.1% (58/2729)	–
		Perinatal mortality rate	24/1000 vs. 21/1000	–
		Preterm birth	8.7% (37/423) vs. 12.3% (336/2729)*	–3.6%
		Birth weight < 2,500 g	11.1% (46/413) vs. 12.0% (327/2729)	–
Nganampa Health Council [19]	Births to mothers from the AP Lands 1984–1990 ( <i>n</i> = 356) compared with births occurring from 1991 to 1996 ( <i>n</i> = 349).	Perinatal mortality rate	45.2/1000 to 8.6/1000 (95% CI around the difference –60.3 to –12.8)	–3.66/1000
		Birth weight < 2,500 g	14.2% (49/345) to 8.1% (28/344) (95% CI around the difference –10.7% to –1.4%) (*)	–6.1%
		Mean birth weight	3,080 g to 3,183 g (95% CI around the difference 5–202 g)	+103 g
Ngu Gundi [20]	Above comparisons dichotomized by: Birthing on the AP Lands (17.6%) or Births in hospital (82.4%).	Perinatal mortality rate	81.4/1000 to 26.3/1000	–
		Perinatal mortality rate	33.6/1000 to 6.5/1000 (95% CI around the difference –50.5 to –3.8)	–2.71/1000
	1993–1996 [20]	Perinatal deaths	3% (4/123) vs. 3% (13/583)	–
	Births to Ngu Gundi antenatal clients ( <i>n</i> = 123) between Feb 1993–Nov 1996 compared with all Indigenous births in the area in the same time period ( <i>n</i> = 583).	Birthweight < 2,500 g	10% (11/123) vs. 12% (59/583)	–
	1997–2000 [22]	Preterm birth	13% (14/108) vs. 13% (13/100)	–
Births at Rockhampton Hospital for Ngu Gundi antenatal clients ( <i>n</i> = 108) between 1997 and 2000 compared with Indigenous women from the Woorabinda community (non-clients) in the same time period ( <i>n</i> = 100).	Birthweight < 2,500 g	9% (10/108) vs. 10% (10/100)	–	
	Strong Women, Strong Babies, Strong Culture [6]	Northern Territory 1990–1996 [6, 24]		
Strong Women, Strong Babies, Strong Culture [6]	Outcomes in the three pilot communities pre ( <i>n</i> = 243) and post ( <i>n</i> = 221) intervention (1990–1 vs. 1994–5) compared with combined data for three other Top End rural communities in the same time periods ( <i>n</i> = 1021 and <i>n</i> = 1018).	Preterm birth in pilot communities	22.4–13.1% (95% CI –16.3 to –2.3)**	–9.3%
		Preterm birth in control communities	13.2–14.0%	–
		Birth weight < 2,500 g in pilot communities	21.0–13.0% (95% CI around the difference –14.8 to –1.1)*	–8.0%
		Birth weight < 2,500 g in control communities	17.4–15.9%	–
		Mean birth weight in pilot communities	2916 (SD 607) to 3024 (SD 551)*	+108 g
		Mean birth weight in control communities	2947 (SD 673) to 3039 (SD 652)	–

**Table 3** continued

Program	Comparison	Outcome	Findings	Absolute difference <sup>a</sup>
	Additional outcomes assessed in the pilot communities	Treated UTI	41.2–33.3%	–
		Anaemia <sup>c</sup>	26.3–41.3% (**)	+15.0%
	Northern Territory 1988–2001 [25]			
	Outcomes in the three pilot communities pre ( <i>n</i> = 577) and post ( <i>n</i> = 829) intervention (Group 1, 1988–93 vs. 1994–2001), in the additional communities where the program commenced in 1996–97 (Group 2, 1988–97, <i>n</i> = 814 vs. 1998–2001, <i>n</i> = 321) and control groups (all rural Top End communities where the program has never been formally implemented, dichotomized for the same time periods, and analysed separately as Group 1 controls ( <i>n</i> = 2,118, <i>n</i> = 3,070) and Group 2 controls ( <i>n</i> = 3,511 and <i>n</i> = 1,677)).	Birth weight < 2,500 g in Group 1 communities	15.3% (95% CI 12.3–18.2%) to 10.9% (95% CI 8.7–13.0%)**	–4.4%
		Birth weight < 2,500 g in Group 1 controls	12.2% (95% CI 10.8–13.7%) to 13.8% (12.6–15.1%)	–
		Mean birth weight in Group 1 communities	2,979 (95% CI 2,925–3,032 g) to 3,114 g (95% CI 3,075–3,154 g)***	+135 g
		Mean birth weight in Group 1 controls	3,066 g (95% CI 3,041–3,091 g) to 3,090 g (95% CI 3,068–3,113 g)	–
		Birth weight < 2,500 g in Group 2 communities	16.8% (95% CI 14.3–19.4%) to 13.0% (95% CI 9.4–16.7%)	–
		Birth weight < 2,500 g in Group 2 controls	13.0% (95% CI 11.9–14.1%) to 13.5% (95% CI 11.9–15.2%)	–
		Mean birth weight in Group 2 communities	2,979 g (95% CI 2,937–3,021 g) to 3,021 (95% CI 2,949–3,092 g)	–
		Mean birth weight in Group 2 controls	3,077 g (95% CI 3,057–3,097) to 3,087 g (95% CI 3,056–3,119)	–
	Western Australia [23]			
	Outcomes pre ( <i>n</i> = 204) and post ( <i>n</i> = 43) intervention (July 1991–Jun 1996 vs. Jul 96–Sept 1997) in five communities in the Kimberley region.	Preterm birth	21% (43/204) to 14% (6/43)	–
		Birth weight < 2,500 g	15% (31/204) to 16.3% (7/43)	–
Yapatjarra Shared Care Program [29]	Perinatal deaths pre and post intervention (Jan–Jun vs. Jul–Dec 2002).	Perinatal mortality rate (descriptive information only)	8 to 2	–

AP, Anangu Pitjantjatjara; CI, Confidence interval; PIH, pregnancy induced hypertension; SD, standard deviation; UTI, urinary tract infection

<sup>a</sup> For statistically significant differences only, defined as \**P* < 0.05, \*\**P* < 0.01, \*\*\**P* < 0.001, as reported in the publication or in parentheses where p-values were calculated by the reviewers

<sup>b</sup> Only singleton births were included in the analyses

<sup>c</sup> Anaemia recorded at any time in pregnancy

women attending one of the care programs compared with other Indigenous women not attending the program [12] (11% vs. 5.1%, *P* = 0.03). This may however, be an indication of increased quality of care leading to increased detection of PIH. Another program reported no difference in the rate of detected and treated urinary tract infections but an increase was seen in the proportion of women found

to be anaemic at any time in pregnancy (26.3% to 41.3%, *P* = 0.001) in communities pre and post-intervention [6]. The cause of the increased anaemia outcome is unclear. There were an increased proportion of women with missing data about anaemia in the post-intervention phase, however, as with PIH, improved quality of care may lead to increased detection of anaemia.

Self-reported smoking, use of alcohol or other drugs were reported by one care program only [12]. In this program, no significant differences were observed in the proportion of women who consumed alcohol during pregnancy compared with Indigenous women having care at two other hospital-based services, or in the proportion of women who smoked during pregnancy. Women attending the care program were however, more likely to smoke more than 10 cigarettes per day compared with other Indigenous women attending one of the other hospital-based services (79% vs. 60%,  $P = 0.01$ ).

#### Women's views about care

The methodologies used to collect women's views about care varied widely, as did the format in which they were reported, for the four care programs reporting on women's experiences or perceptions of care and/or community discussions about the care programs [11, 12, 14, 27]. Table 4 describes both the positive and negative views expressed about services, as they relate to the individual care programs. Not surprisingly, many of the reported comments were positive reflections about care, with negative comments most often related to waiting times or staffing/organizational issues.

#### Measures of cost

Only one program directly reported information about a costing analysis [12]. The analysis took into account the running costs of the program minus the cost savings to other centres occurring through women utilising the specific care program services. Downstream health sector costs and savings, described as the difference between health resources consumed by clients compared with other Indigenous women (non-clients) giving birth at the same hospital as the program clients were also taken into account. Annual net health sector costs were estimated as AUD \$74,414 (\$1,772 per patient), with a downstream health sector saving of \$507 per client compared with non-client. This cost saving was due primarily to the shorter postnatal length of stay in hospital seen for clients of the care program.

## Discussion

Despite extensive searching we were only able to find published evaluations for 10 antenatal care programs for Australian Indigenous women. This is almost certainly a reflection of a lack of evaluations rather than a lack of activity in the area of antenatal care (e.g. funding for programs for Australian Indigenous women). Of those

programs that had been evaluated and published, we found modest increases in indicators of antenatal care utilization, most notably increases in the proportion of women accessing antenatal care in the first trimester. For birth outcomes, benefits were seen in some but not all care programs for the risk of preterm birth and low birth weight babies, in addition to increases in mean birth weight over the time period of the evaluations. Despite these benefits being of potential clinical importance, there was a lack of consistency in these and other outcomes across all care programs, making it difficult to determine the overall effect of care programs, and ultimately to make recommendations about care. Importantly, none of the programs reported any detriments to the health of the women or their infants.

The lack of consistency in findings related to birth and other outcomes is not surprising for a number of reasons. Comparing the findings of individual care programs was made difficult by the diversity in comparison groups used in the evaluations. Many used a historical control group, which can lead to difficulties in distinguishing the impact of an intervention from underlying trends in the outcome over time. Other groups compared outcomes for other Indigenous women giving birth in the same time period but not attending the care programs. These kinds of comparisons are limited by women "self-selecting" or choosing to attend the intervention care programs, and it is likely that these women differ systematically from women not attending the care programs. This potential bias may be manifested by women in the care programs having a higher risk profile in pregnancy, or conversely higher risk women may instead opt to have care at a tertiary level service. Indeed, the interventions in this review were not randomly allocated to communities; therefore it is difficult to accurately assess the effects of the interventions, without considering the baseline health risk factors in the populations assessed as well as other changes in health services that may have occurred over the same time period. Other care programs used routinely collected pregnancy statistics (required for government reporting purposes) to demonstrate trends in birth outcomes occurring in the geographical location of the care program. While the use of such information may be necessary due to a lack of availability or quality of data from the individual health services, it is difficult to demonstrate causality, particularly when there are other health services available in the same location.

Our review has a number of limitations which must be considered, but perhaps the most important is the potential for publication bias. None of the care programs identified in this review demonstrated any real detriments to women's health for those women attending the care programs. It remains possible that care programs that may have resulted in no overall benefit or even harmful effects on the health of women and their infants may not have been re-



**Table 4** Women's views about the care programs

Program	Methods	Comments
Congress Alukura [11]	Key informant interviews, group discussions and women's meetings were employed as a part of a comprehensive review of Alukura's services, including an assessment of why women were not utilizing the birthing facilities.	<p>Positive comments emerging from the discussions related to Alukura's strong links with remote bush communities. The identified links included the mobile bush clinic (considered by many as one of Alukura's strengths), the health promotion projects and the attendance at Alukura's festivals and events.</p> <p>The discussions revealed a consistent range of reasons for women not birthing at Alukura, including:</p> <ul style="list-style-type: none"> <li>• more practical support (food and laundry) was provided by the hospital than Alukura</li> <li>• perceived safety and normality of hospital births</li> <li>• the likelihood of relatives, friends or people from one's own community already being at the hospital</li> <li>• loss of links with the Grandmothers Law among young birthing women (and their mothers)</li> <li>• negative views of Alukura and gate-keeping by bush clinic staff (directing women to the hospital instead)</li> <li>• lack of promotion of Alukura and the position of Alukura relative to the town, shops and friends</li> <li>• extra demands placed on staff when a birth is imminent</li> <li>• the higher proportion of Aboriginal women with serious pregnancy and birth complications</li> <li>• the preference for partners being with women after and sometimes during the birth.</li> </ul>
Daruk Antenatal Program [12]	Women's views about care were drawn from six focus groups involving Indigenous women who used the Daruk antenatal program, including women who (prior to 1990) accessed mainstream services. Questionnaires were also distributed opportunistically to women using Daruk and women who used Nepean and Blacktown hospitals ( $n = 63$ ).	<p>Positive experiences of the Daruk program were expressed around seven key themes identified in the focus groups and interview sessions, and included:</p> <ul style="list-style-type: none"> <li>• on-going building of relationships and trust with women and the Indigenous community (particularly through a non-judgmental approach)</li> <li>• providing more accessible antenatal care (through transport services, informal child care and less waiting time)</li> <li>• flexibility (including home visiting services)</li> <li>• clear and appropriate information</li> <li>• continuity of care (including labour, birth and postnatal support)</li> <li>• empowerment</li> <li>• family-centered care (including social support).</li> </ul> <p>Negative views about Daruk related to a perceived stigma associated with a service primarily for the Indigenous population and Daruk being seen as a service for the disadvantaged making it irrelevant to some women's needs.</p>

Table 4 continued

Program	Methods	Comments
Gumileybirra Women's Health Service [14]	Women's views on care were collected through interviews with 17 women and questionnaires from 22 women, as part of a client feedback project.	<p>Positive views about Gumileybirra most often related to staff (52 of 110 comments) as well as the clinic environment. The most common positive comments included:</p> <ul style="list-style-type: none"> <li>• the presence of only female staff (nine women) and Aboriginal Health Workers (seven women)</li> <li>• staff attitudes including being friendly (five women), helpful (five women) and kind or good (five women)</li> <li>• the 'comfortable' clinic environment including appreciating a 'women only' area (six women)</li> <li>• feeling a sense of ownership of Gumileybirra (five women).</li> </ul>
Women's Business Service (WBS) [27]	The views and experiences of women who received maternity care at the WBS ( $n = 25$ ) were compared with rural Victorian women who participated in the Statewide Victorian Survey of Recent Mothers 2000 and who had received public maternity care ( $n = 333$ ). <sup>a</sup>	<p>Negative feedback was expressed less frequently than the positive feedback. Negative comments most often related to staffing and organizational issues including the need for improved waiting times, especially to see a doctor (six women) and opening the clinic for more than 2 days a week (four women), as well as a range of suggestions about how the service could be improved.</p> <p>Compared with the rural survey participants, WBS clients were significantly* more likely to say that:</p> <ul style="list-style-type: none"> <li>• doctors and midwives always kept them informed (96% vs. 54%)</li> <li>• that midwives were never rushed (96% vs. 52%)</li> <li>• that they never waited more than 1/2 an hour (84% vs. 17%)</li> <li>• that they were always happy with their medical care in pregnancy (88% vs. 56%)</li> </ul> <p>WBS clients also were more likely to rate their antenatal care as 'very good' (80% vs. 60%, 'borderline statistical significance only').</p> <p>For care during labour and birth, WBS clients were:</p> <ul style="list-style-type: none"> <li>• more likely to have known at least one of the midwives who cared for them 'very well' (56% vs. 11%)</li> <li>• more likely to report they were given an active say in what happened during labour and birth (76% vs. 63%)</li> <li>• less likely describe staff at the birthing hospital as very friendly and welcoming (48% vs. 71%)<sup>b</sup> (<math>P &lt; 0.05</math>)</li> </ul> <p>When asked to comment on aspects of their antenatal care, the five aspects that women most often nominated that they were particularly happy with included the home visits by WBS staff (16/25), sensitivity, kindness, reassurance and respect shown by care providers (10/25), having care providers who were on-call and easy to contact (9/25) and the availability of transport (6/25).</p>

\* Statistical significance at  $P < 0.01$ , unless otherwise stated

<sup>a</sup> Compared with the rural survey participants, WBS clients were more likely to be aged < 20 years, have a pension or benefit as their main source of income, to have smoked during pregnancy and to have an infant weighing less than 2,500 g. The groups were comparable for parity, preterm birth, spontaneous onset of labour and mode of birth

<sup>b</sup> Two WBS clients had a homebirth and were not included in this comparison

ported or published and therefore evaded detection for our review. Other care programs may not have been detected for this review due to a lack of dissemination of findings to the wider public (including research and policy audiences). This may occur particularly where evaluations are not undertaken by researchers or for the purpose of research.

We are also certain that there are other un-published Australian programs that have implemented strategies to increase Indigenous women's utilization of antenatal care but which have not been formally evaluated, either at all or beyond the reporting of performance indicators required by some funding agencies. In trying to reduce the potential for publication bias, we searched various sources of 'grey' literature (i.e. information that is not commercially published and not accessible through conventional search engines); however it remains possible that potentially relevant sources of information have not been identified. For example, at the time of completion of this review we became aware of another literature review of relevance to this topic [38], which included the majority of antenatal care programs reported in our review. This Australian Government report was not available in the academic literature and there were delays in adding the report to the relevant website, leading to delays in dissemination of findings to the wider public.

Almost all of the care programs included in this review reported perinatal mortality trends. While the very nature of mortality rates make them a "hard outcome" (i.e. relatively unlikely to be influenced by measurement and other errors), none of the evaluations had sufficient statistical power to be able to show clinically important differences in perinatal mortality or other pregnancy and birth outcomes. With the exception of one antenatal care program (which incidentally did not report birth outcomes) [27], none of the care programs reported a power calculation for the study evaluation. It is unrealistic to expect to show a significant change in perinatal mortality from care programs that might see on average, 50 new antenatal patients per year, as was typical in the care programs identified in this review. Only with the collection and reporting of good quality longitudinal data about these and other care programs, will clinically relevant differences in perinatal outcomes be able to be demonstrated. Unfortunately, good quality longitudinal data about Australian Indigenous mothers and their babies is not yet available even on a national level [4], due in part to difficulties in the accurate ascertainment of Indigenous status of both mothers and fathers.

In Australia, maternity health services (including antenatal care) are provided by obstetricians, midwives, general practitioners, nurses and Aboriginal health workers, working within hospital obstetric units, birthing centres, community controlled health services, government clinics and private practitioner rooms. Despite the diversity in

antenatal care providers available in Australia, there are no national guidelines regarding the provision of antenatal care. As a result, variations in the content of antenatal visits and recommended antenatal screening procedures exist across Australia [39], which can contribute to inequalities in care and outcomes.

Factors affecting the provision of high quality antenatal care to Indigenous women are likely to be different in rural and remote settings compared with urban areas. In remote areas, challenges exist around the delivery of health services to small discrete communities often in sparsely populated areas; however improved access to appropriate health services has occurred with the initiation of local Aboriginal community controlled health services. In urban areas, Indigenous people may access a range of providers of primary health care services, not just community controlled health services [40], which highlights the need to ensure mainstream service providers are responsive to the needs of Indigenous people, and can work effectively in a cross-cultural environment.

It is important to take a long-term view when assessing the impact of antenatal care programs developed specifically for Indigenous women. There are clear disparities in health outcomes faced by Indigenous women compared with other Australian women. These are not limited to pregnancy and childbirth, and it may not be possible to rectify such vast disparities in the short term. Given that the programs often represent a partnership between ACCHS and mainstream services, reaching the women in most need of these care programs may require addressing some of the long-held issues surrounding mistrust of mainstream services. In addition, there is a limited workforce available for these programs, many of which were undertaken outside of major cities or even in remote areas. Few programs however, addressed issues surrounding the long-term sustainability of the program in their evaluation.

The difficulties in comparing the care programs in this review highlight the tensions often seen in health services research between good research practice that is grounded in consistency and comparability of findings versus adequate and appropriate provision of care that responds to local needs and situations. Indeed, rigorous care evaluations often require significant time, expertise and financial investment which simply may not be feasible within already under-resourced health services. It is therefore not surprising that many of the evaluations in this review were limited by the quality and availability of data. For some comparisons there was incomplete capture of data, and in some instances conclusions were drawn about programs that were not explicitly supported by the evidence reported in the publications. These findings highlight the need for provision of adequate resources to ensure that health care evaluations are undertaken with appropriate rigour and

reproducibility, and have the ability to produce meaningful findings that could be generalized to other populations. In the meantime, however, the limited high quality data demonstrated in this review should not impede the implementation and support of antenatal care programs for Australian Indigenous women, when there are clear inequalities in women's access to appropriate care.

Women's views about care form an important part of assessments of health care interventions. In this review, only four care programs formally reported on women's experiences or views of care, and not surprisingly, most of the discussions about the care programs were positive. The use of female staff, supportive staff attitudes and the continuity of care approach used in the services were commonly "liked" aspects of care. The importance of women's satisfaction with care must not be underestimated, and it may be that changes in women's views about services (in contrast to quantifiable health outcomes) are the primary short term outcomes. This may be particularly true for organizations that see only small numbers of women per year. There may also be other outcomes that cannot be easily quantified, for example women "re-claiming cultural pride" or the "empowerment of women". Statements such as these were often expressed in the publications about care programs, although not substantiated quantitatively. Women's satisfaction with care may be an important part of an assessment of the opportunity-costs of a care program, and this highlights the need for the collection and reporting of qualitative aspects of care in addition to quantitative measures of health outcomes.

## Conclusion

Indigenous people in Australia, the United States, Canada and New Zealand share a common history of dispossession of land and culture, and common experiences of disadvantage, marginalization and disproportionately high rates of adverse health outcomes compared with non-Indigenous people. There are however, no greater disparities in health outcomes than those seen for Australian Indigenous men, women and children relative to other Australians [41, 42]. In this review, the importance of providing care that addresses the needs of Australian Indigenous women is not disputed. However, assessing the impact of the antenatal care programs that have been developed and evaluated to date was problematic, particularly due to the short term focus of many of the evaluations. While some benefits were seen in relation to increased utilization of care in early pregnancy, improved birth outcomes and women's views about care, it was difficult to compare the individual care programs in a meaningful way. Any comparisons made

were hampered by the uneven quality and availability of the data reported from the care programs.

While the antenatal care programs reported in this review may be culture specific, the mechanisms of service delivery may be transferable to other Indigenous populations, but only if the evaluations are well conducted and widely disseminated. This review has highlighted the need to implement systems that will enable long term high quality data collection about the health services, and the health of women and infants utilizing the services.

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